CLAIMS

1. A join process for a wireless mesh topology network where network nodes have multiple spatial coverage sub-sectors together covering a larger sector angle, where a node can establish connection with other nodes located in directions covered by its sub-sectors, the join process for adding a joining node to the network comprising:

the joining node starts listening to its sub-sectors at specific receiving frequencies for a defined time and thereafter changes its sub sectors and its receiving frequencies according to a defined timing and sequence; and

active network nodes transmit organized invitation data packets on defined sectors, frequencies and timing, based on their relative location and relative angle orientation deduced from sub-sectors already used for existing internal network communication, thus reducing frequency interference and reducing time required for the join process.

2. The join process of claim 1 further comprising:

one active network node distributes the schedule for the organized invitation data packets to other active network nodes.

3. The join process of claim 1 further comprising:

an external computer which distributes the schedule for the organized invitation data packets to the network nodes.

4. The join process of claim 1 further comprising:

communicating using only a single sector which covers a single spatial sector from one active network node having a single spatial coverage sub-sector.

5. A method for admitting a joining node to a wireless mesh network, the method comprising:

transmitting an invitation packet from one or more active nodes of the wireless mesh network at synchronized scheduled transmission times, frequencies, and scheduled transmission directions over defined spatial directions, and

after a delay time, detecting a transmitted response from the joining node at defined spatial directions.

6. The method of claim 5 wherein transmitting the invitation comprises transmitting data about the predetermined delay time for use by the joining node transmitting the response.

7. The method of claim 5 wherein transmitting comprises:

scanning an initial direction; and

subsequently, scanning first other directions in a predetermined order while skipping second other directions in order to reduce locating time for the joining node.

8. The method of claim 5 wherein transmitting comprises:

transmitting multiple invitations to respective portions of coverage space of a node of the wireless mesh network.

9. The method of claim 8 wherein transmitting further comprises:

transmitting multiple invitations on respective antenna beams.

10. The method of claim 8 wherein transmitting further comprises:

transmitting multiple invitations at respective frequencies.

11. The method of claim 5 wherein transmitting comprises:

transmitting non-overlapping invitations from two or more nodes of the wireless mesh network.

12. The method of claim 11 further comprising:

at non-transmitting nodes of the wireless mesh network, suspending transmissions which could interfere with the non-overlapping invitations during transmission thereof.

13. The method of claim 5 wherein transmitting comprises:

transmitting the invitation from a first set of inviting nodes during a first invitation period; and

transmitting the invitation from a second set of inviting nodes during a second invitation period.

14. The method of claim 13 further comprising:

selecting the first set of inviting nodes and the second set of inviting nodes according to predetermined scheduling criterion.

15. The method of claim 14 further comprising:

selecting members of each set of inviting nodes to reduce possibility that the joining node will substantially simultaneously be detecting in direction of the same coverage area of more than one active node of the wireless mesh network.

16. The method of claim 5 wherein detecting a transmitted response comprises:

configuring the one or more nodes for detection of the transmitted response.

17. The method of claim 5 wherein detecting a transmitted response comprises:

configuring network nodes for detection of the transmitted response during a listen time period.

18. The method of claim 17 wherein configuring comprises designating a plurality of nodes for detection of the transmitted response; and

scanning non-overlapping portions of the coverage space of the wireless mesh network.

19. The method of claim 18 wherein scanning comprises:

at each node, scanning at least one of communication sectors and frequencies so as to detect the answer transmitted from the joining node in a unique location of the coverage space of the wireless mesh network.

20. The method of claim 5 further comprising:

at a control location, authorizing only the one or more nodes to transmit the invitation.

21. The method of claim 5 further comprising:

designating the one or more nodes based on respective coverage space of nodes of the wireless mesh network.

22. The method of claim 21 wherein designating comprises:

designating the one or more nodes based on geographic coverage space of respective nodes.

23. The method of claim 21 wherein designating comprises:

designating the one or more nodes based on frequency coverage space of respective nodes.

24. The method of claim 21 further comprising:

receiving information about location of the joining node; and

relating the position of the joining node and coverage space of nodes of the wireless mesh network.

25. The method of claim 24 further comprising:

prioritizing one or more portions of the coverage space of the wireless mesh network for transmitting the invitation based on the information about the location of the joining node.

26. The method of claim 5 further comprising:

determining position information for the joining node based on the transmitted response..

27. The method of claim 24 further comprising:

receiving radio link directional information in the answer at a node of the wireless mesh network; and

from the radio link directional information and position of the node, determining the position information for the joining node.

28. The method of claim 5 further comprising:

resolving a collision from substantially simultaneous responses of two or more joining nodes using an exponential back off process at the joining nodes.

29. A method for adding a joining node to a wireless mesh network including at least a first network node and a second network node, the method comprising:

receiving location information for the joining node;

designating at least one network node for initiating communication with the joining node;

transmitting invitation packets at the at least one network node in a direction towards an anticipated location of the joining node; and

receiving an answer at a network node in response to an invitation packet.

30. The method of claim 29 further comprising communicating between the network node and the joining node for selecting antenna spatial sub sectors for optimal communication.

31. The method of claim 29 wherein transmitting comprises:

transmitting invitation packets at a first network node at a first frequency; and

substantially simultaneously, transmitting invitation packets at a second network node at a second frequency.

32. The method of claim 29 wherein transmitting comprises:

at the first network node, scanning sectors according to a first order; and

at the second network node, scanning sectors according to a second order to avoid collision in receiving the answer.

33. The method of claim 32 wherein the first order and the second order change for each scan.

34. The method of claim 32 wherein the first order and the second order differ if the first network node and the second network node are neighbors.

35. The method of claim 29 wherein receiving location information comprises:

receiving coordinate data from a global positioning system (GPS) receiver located proximate the joining node.

36. The method of claim 35 wherein receiving coordinate data comprises receiving the coordinate data from a GPS receiver integrated with the joining node.

37. A method for adding a joining node to a wireless mesh network including one or more network nodes, the method comprising:

designating at least one network node for initiating communication with the joining node;

at the at least one network node, to initiate communication with the joining node, scanning on a first sector with highest probability of locating the joining node;

subsequently scanning on sectors of lower probability of locating the joining node; and

receiving an answer at a network node in response to an invitation packet.

38. The method of claim 37 wherein subsequently scanning comprises:

scanning on sectors immediately adjacent to the first sector; and

subsequently scanning on sectors immediately adjacent to the sectors immediately adjacent to the first sector.

39. The method of claim 37 wherein subsequently scanning comprises:

skipping scanning on sectors immediately adjacent sectors already scanned; and

subsequently scanning on sectors immediately adjacent to the skipped sectors.

40. The method of claim 37 further comprising:

receiving information about location of the joining node;

based on the information about location of the joining node, identifying the first sector with highest probability of locating the joining node.

41. The method of claim 37 further comprising:

receiving information about location of the joining node;

based on the information about location of the joining node, identifying those network nodes with highest probability of locating the joining node; and

assigning each identified network node to transmit in the direction of the location of the joining node.

42. The method of claim 37 further comprising:

transmitting an invitation transmission from the at least one network node; and

synchronizing at least one of time, direction and frequency of the invitation transmission by the at least one network node to avoid interference at the joining node.

43. A method for admitting one or more joining nodes to a wireless mesh network, the method comprising:

scheduling transmission of data packets by inviting network nodes on defined frequency channels and at defined directions to create spectral activity for detection of the spectral activity by the one or more joining nodes; and

at a joining node of the one or more joining nodes,

scanning the defined frequency channels and at different spatial directions to identify radio frequency activity of the inviting network nodes at the defined frequency channels,

identifying spatial directions toward the inviting network nodes, and

tuning to a defined frequency channel in the identified spatial direction to receive an invitation packet transmitted by the inviting network nodes between the data packets..

44. The method of claim 43 wherein transmission of data packets comprises:

transmitting a radio frequency activity burst of information at a defined frequency channel and in one or more defined spatial directions.

45. The method of claim 43 wherein the data packets comprise short bursts of data, have a duration shorter than duration of the invitation packets and are transmitted more frequently than the invitation packets.